THURSDAY, OCTOBER 10, 1901.

RATIONAL GEOMETRY.

Plane and Solid Geometry. By Arthur Schultze, Ph.D., and F. L. Sevenoak, A.M., M.D. Pp. ix+370. (New York: The Macmillan Company, 1901. London: Macmillan and Co., Ltd.) Price 6*s*.

THIS is an excellent work for all young students who wish to begin the study of geometry. In its order of treatment it completely ignores Euclid, and thus saves the young pupil from a long and wearisome waste of time, giving him clearly and rapidly a knowledge of the subject and an insight into its nature and purpose. We wish that the English schoolboy could congratulate himself on its appearance; but this is forbidden by our conservatism and the attachment of our public and preparatory schools to mediævalism. When an Educational Reformation takes place in England—and there are signs of its advent—such a work will be welcomed by all of us who are interested in the scientific education of the people.

The book is divided into two parts—Plane Geometry and Solid Geometry. The first part is divided into five books (225 pages), and the second into three (93 pages). The type is excellent, and the figures (especially those in the second part) beautiful.

To enter now into a few matters of detail, we would suggest to the authors that they should not have followed the English plan of beginning with a catalogue of fifty definitions before the pupil reaches the real work of the subject: this makes for tediousness. The term *straight angle* (adopted, apparently, from the A.I.G.T.) is, we think, very objectionable, because the notion of straightness should be kept quite distinct from that of an angle. The first proposition in the book, "vertical angles are equal," is Euclid's 15th; prop. 2 is Euclid's 26th; prop. 3 is Euclid's 4th; prop. 4 is Euclid's 16th. Thus a common-sense order of treatment is freely adopted. Then comes the treatment of parallel lines in which all of Euclid's results are given. The definitions of degrees, minutes, and seconds are given in the preliminary definitions (p. 5), but the protractor is not mentioned, so that the actual way of reading the value of a given angle is not exhibited. This omission of the protractor seems to us to be a mistake. Some propositions are merely enunciated, and, instead of a formal proof, a "hint" to the pupil in a few words is given. This is good, because it exercises, without severity, the power of the young thinker. The famous Asses' Bridge is given as prop. 14, with the mere hint that it would be obvious if the bisector of the angle at the vertex were drawn—as, of course, it would be. Herein observe the contrast to Euclid, who would not allow us to use this bisector unless he had previously shown how to construct it—a perfectly useless restriction which runs through the whole of Euclid. Of course it is subsequently shown (p. 35) how to bisect an angle and a line. The authors are generally precise in their use of language, without adopting the grotesque show of accuracy in our school Euclids. Nevertheless, they occasionally make an absurd use of the word *respectively*, which is so prominent in these works. Thus (p. 30), "two triangles are equal if the three sides of the one are respectively equal to the three sides of the other"; clearly no *order* of equality is necessary. See also end of p. 74.

In p. 33 and elsewhere the authors boldly define a circle as an area, and distinguish it from its bounding curve, which they call "a circumference." If we punch a wad out of a sheet of cardboard, which area has the right to be called the circle—the wad or the whole of the outside area of the sheet?

In this respect, however, the authors are consistent, while Euclid is not. Euclid's formal definition makes the circle an area, while in his Book III. he says that two circles cannot have more than two points in common.

The English barbarism involved in the proposition "if two sides of a triangle are equal, the opposite angles shall be equal," is consistently avoided, the simple word "is" or "are" being always used instead of the compulsory and ridiculous "shall be" of our school Euclids.

The second book of Part i. treats of the circle, and travels over the ground of Euclid's III. and a little more, arithmetical examples being occasionally given—a great desideratum in our English system. Here measurement and ratio are introduced, as well as the notion of limits—a great improvement. Euclid's first book problem, "to construct a triangle when its three sides are given," appears here as prop. 19—a postponement of more than doubtful value.

The third book is on proportion and similar polygons, and the propositions are illustrated and explained by simple algebra and arithmetic; thus the beginner can learn the essence of the subject in a few minutes without wasting a lifetime on Euclid's Book V. In this book the authors give the propositions relating to the equality of areas, of triangles, and parallelograms, while the proposition of Pythagoras now appears for the first time (p. 147), founded on the similarity of the two triangles into which a "right triangle" is divided by the perpendicular from the vertex on the hypothenuse; the old proof and time-honoured figure are, however, given in the next book (p. 178). Near the end of the third book we have Euclid's well-known proposition whose trigonometrical form is $c^2 = a^2 + b^2 - 2ab \cos C$, the proof being, of course, geometrical, but presented in algebraic form.

The fourth book treats of the areas of polygons, and the proofs are presented in algebraic form. The exercises all through are numerous and very appropriately placed.

In the part dealing with solid geometry and the fundamental properties of spherical triangles, the figures are, as we have said, exceedingly good and realistic.

In p. 264 we have the proposition "the sum of any two face angles of a triedral angle is greater than the third face angle"; but the proof will have to be slightly modified, as, in its present form, it is confusing for the beginner. Thus, to the words "in the face AVC draw VD equal to VB, making $\angle$ DVA = $\angle$ BVA," it may fairly be objected that this is impossible if the points A and C are already given. The line VD should first be drawn, and then the lines ADC and BC. Again, in

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p. 205, the proposition "the circumference of a circle is less than the perimeter of any enveloping line" has no special reference to a circle—it is true of any oval figure whatever, and no special property of the circle is employed in the proof. We think that it should be struck out as misleading. Finally, we must point out that the Socratic method of teaching the pupil by a system of questioning—the most efficient of all teaching methods—is adopted throughout the book. The limited space at our disposal has not by any means allowed of such an exhaustive exhibition of its merits as this work deserves. GEORGE M. MINCHIN.

NATIVE LIFE IN SOUTHERN INDIA.

Occasional Essays on Native South Indian Life. By Stanley P. Rice, Indian Civil Service. Pp. vi + 223. (London: Longmans, Green and Co., 1901.) Price 10*s.* 6*d.* net.

THESE sketches of south Indian life are concerned, not with any of the districts, like Madura or Tanjore, in the extreme south of the peninsula, but with Ganjam, which while politically connected with the Madras Presidency, is by the race, language, and customs of its people more closely linked with the Bengal Province of Orissa. This political separation from his northern kinsfolk has worked evil to the Uriya of Ganjam. The ordinary Madrasi looks on him as an inferior creature, "not merely low in the rank of civilisation, but incapable of better things"; and he is carefully excluded from the official employment which is monopolised by his Telegu neighbours in the south. Hence, as might have been expected, he has no ambition to develop his own language or literature, and he remains a boor, slovenly in his mode of life, and with little love for the foreign native officials who manage his affairs. But he is not quite destitute of good qualities. He is a hard-working farmer; he is not given to drink, like the Telegu; and Mr. Rice vouches for the fact that, when addressed in his own tongue by one who understands and appreciates him, he is courteous and hospitable. But still there is a vein of savagery beneath his boorish exterior, as is shown by the graphic account given by Mr. Rice of the so-called Rebellion of Parlakimedi, which plunged the land in ruin and anarchy during the early years of last century. As usual in such cases, it arose from the apathy and ignorance of the early officials; and it was not till many years had passed in maladministration that a strong man was found at last in Mr. George Russell, one of those little-known heroes of our Indian services, who gave the land peace which has never since been disturbed.

Mr. Rice, though a careful and sympathetic observer of native life, seems to have little knowledge of Indian anthropology and folklore. This is perhaps not an unmixed disadvantage. He does not come, like some of our Indian officials, ready to apply book learning to the study of savage life; nor is he primed with that modicum of acquaintance with comparative anthropology which leads him to see a totem in every bush, or a tree-god in all rural ceremonies. But had he possessed a wider acquaintance with some of the problems which anthropology attempts to solve, his studies could have hardly failed to gain in precision and interest.

We have in Ganjam an excellent example of three overlapping races. The Uriya of the plain cou ntry is a Dravidian with a certain amount of Aryan inter mixture. His language is not "a blend of Sanskrit and Hindustani," but a form of Bengali affected by the Telegu or other South Indian tongues. A wider study of linguistics would make it clear to Mr. Rice that the word Ponda for a priest, which puzzles him, is merely the Sanskrit *panda*, "a learned man."

Next on the lower hills come the Khonds or Khânds, who seem here to have preserved no tradition of the Meriya sacrifice through which they are best known to ethnologists. They are a race of half savages already half ruined by the trickery of the Uriya Shylock, and deprived of their old mode of livelihood in the jungles by the repressive rules of the Forest Department.

Still further back in the more remote hills are the Savaras or Sauras, who enjoy a free savage life, periodically burning down the jungle to sow their scanty crops, but living mainly on the fruits and roots which the forest supplies. But they possess some traditions of a more settled life, because it is their law that the dead man must be cremated with the wood of the mango, and this must be done "in the portion of ground—one cannot call it a field—which he last occupied." Of course this may be a sign of Hindu influence, but Mr. Rice does not say so, and Mr. Risley's account of the race in Bengal does not support the suggestion.

Of the marriage rites of these jungle people Mr. Rice gives some interesting details, but he misses the point of some of their practices because he has not grasped the fact that they indicate a reaction against the early custom of "Beena" marriage, in which the bridegroom is adopted into the clan of his wife. This still prevails among the Savaras, where if the bride's father agrees to the alliance, "he and the bridegroom elect to go into partnership and cultivate for two or three years."

The religion of these races is, as usual, of the animistic type, but it has been largely influenced by the Orissa cult of Jaggannâth. Witchcraft, of course, and the custom of rendering the witch harmless by knocking out the teeth, prevail widely. Special respect, which may be totemistic, but is more probably the survival of some animal cult, is paid to the bear, "as they have a curious fancy that the souls of their ancestors inhabit the bodies of bears after leaving their human prison." Mr. Rice has never been able to discover why, when building a house, they plough up the site and sow some grain after consulting a priest or seer. This is a common form of mimetic magic, performed with a view to ensure the prosperity of the household.

We trust that if Mr. Rice has the good fortune to be again posted to such an interesting district as Ganjam he will continue his studies among those wild races about whom he displays such a sympathetic interest. But he would come better prepared for such inquiries if he mastered Mr. Risley's account of the tribes of Bengal and other equally accessible works on Indian ethnology and folklore.

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